

**Chemical Propulsion Information Agency (CPIA)****CPIA****Story 1****Story 2****Shoulder-launched Missiles Tested for Sound Pressure and Exhaust Gas**

In response to an information request from a U.S. missile contractor, CPIA researched and successfully located sound pressure level and exhaust gas toxicity data for representative shoulder-launched missiles that were test fired from within an enclosure.

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NATO Research and Technology Organization (RTO), Advanced Vehicle Technology AVT Working Group (WG)

The final report of a four-year NATO effort to evaluate solid propellant burning rates has recently been completed under the direction of a senior CPIA Rocket Scientist. A senior CPIA technical staff member chaired The NATO Research and Technology Organization (RTO), Advanced Vehicle Technology (AVT) Working Group (WG) 016 (formerly AGARD/PEP Working Group #27 multi-year effort to evaluate methods used within the NATO propulsion community to measure burning rate in solid propellant rocket systems. The purpose was to identify similarities and differences among the member nations. The WG 016 sought to contribute to improvements in the burning rate tools by addressing issues that have remained unresolved in the solid propulsion industry for over 40 years:

- Better understanding of burning rate, $rb(p, T_o)$, data from various facilities to ease the comparison of propellants from various manufacturers and to improve international exchanges and cooperation.
- Improved measurement accuracy and reliability to allow a decrease in the number of tests (and associated time and cost) and improved control of manufacturing and quality assurance and the assessment of aging.

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**Chemical Propulsion Information Agency (CPIA)****CPIA****Story 1****Story 2****Shoulder-launched Missiles Tested for Sound Pressure and Exhaust Gas (continued)**

This information supported a critical near-gunner safety study conducted for the U.S. Army's Tube-launched, Optically engaged, Wireless Fire & Forget (TOW F&F) anti-tank missile which is currently in engineering and manufacturing development (EMD). CPIA's thorough and rapid response prevented a costly test program that would have duplicated data that already existing in the agency's technical reports collection and database.



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AVT WG 016 was formed in 1996 with a senior engineer from CPIA as chairman of the working group. The Working Group membership consisted of active representatives from 6 of the 15 member nations of NATO, which included France, Germany, Italy, The Netherlands, United Kingdom, and the United States. Six meetings were held at various sites from October 1996 through October 1999 and 30 facilities from 12 countries were surveyed for the characteristics of solid propellant burning rate test and analysis methods employed. The list of facilities includes Canada (1), France (2), Germany (3), Italy (2), The Netherlands (1), Norway (1), Portugal (1), Spain (1), Turkey (1), United Kingdom (1), and the United States (16). Over 75 individuals from these facilities contributed to this compendium of international burning rate measurement methods.

The recently completed final report represents a complete survey of all major international facilities involved in burning rate measurement and a thorough presentation of the fundamental methods used in the solid propulsion community today. Peer review of the results and conclusions was sought outside the WG throughout this effort. This report provides the final results of this study, including the objectives, approach, detailed findings, and recommendations of this working group based on activity from October 1997 to August 2001.

Burning rate fundamentals are reviewed and industrial test and analysis practices currently in use by the facilities surveyed are thoroughly documented. Detailed recommendations are provided on direct and non-intrusive burning rate measurement test hardware and test methods, data analysis methods, and performance scaling to support improved prediction of internal ballistics of full-scale solid propellant motors. AVT WG 016 activities have identified that manufacturer burning rate data may not easily be compared without accounting for industry-wide differences in subscale devices, test methods and scaling analysis methods. The WG recommended the NATO propulsion community review these findings as a means of advancing their own burning rate measurement and analysis methods.

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